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INFORMATION CIRCULAR 22

Pennsylvania Geological Survey

Fourth Series

GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP MEDIA QUADRANGLE

by

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1959

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FOREWORD

Southeastern Pennsylvania is an area of extremely varied and complex geology with a long history of mineral production. The list of mineral commodities which this area has yielded at various times is considerable, but iron-ore stands out as the most prominent. Scores of iron mines and furnaces have operated in this area in the past 200 years. With a record of production dating back to Pre-Revolutionary War years, the mine at Cornwall is America's oldest continuously operating iron mine in the United States. The recent development of the large and magnificent Grace Mine at Morgantown is living testimony to the fact that Pennsylvania's metallic mining record is not simply a story of the past. Through modern methods of exploration and research, new mineral resources remain to be found.

The Bureau of Topographic and Geologic Survey of the Department of Internal Affairs is pleased to have participated and cooperated with the U. S. Geological Survey in carrying out an aeromagnetic survey of Southeastern Pennsylvania. This modern exploration technique is particularly well suited to the geologic conditions and to the potential mineral resources of the area; it is an extremely efficient method of acquiring geologic data for a large region. The results of the aeromagnetic survey are being published by the U. S. Geological Survey as a series of aeromagnetic contour maps.

We are pleased to present this publication as a service to the Commonwealth of Pennsylvania. It is hoped that this interpretation and discussion of the aeromagnetic maps will serve as a stimulus for further research and development.

Genevieve Blatt

Genevieve Blatt, Secretary
Department of Internal Affairs

GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP MEDIA QUADRANGLE

General Statement

The magnetic contour maps being discussed in this series of publications are the result of a cooperative project of the United States Geological Survey and the Pennsylvania Geological Survey, Department of Internal Affairs. About 10,000 square miles of southeastern Pennsylvania have been covered in this survey, the results of which are being published as individual $7\frac{1}{2}$-minute quadrangle maps.

This information circular is one of a series intended as a preliminary explanation of the interrelation of distinctive magnetic features with geological conditions in each quadrangle. In many instances unusual magnetic patterns can be explained by geological features which have been mapped and studied in the past. It is hoped that the map viewer will not only be aided by such correlation of data, but that this publication may stimulate exploration and research in those areas where there is at present no known or satisfactory geological explanation for some of the magnetic features which appear on the magnetic contour map. Such exploration and research could directly or indirectly lead to discovery and development of new mineral deposits and would greatly further the basic knowledge of the geology of Pennsylvania.

The magnetic contour lines on the map are lines connecting points of equal magnetic intensity. The shape, position, and spacing of the magnetic lines are due to the combined effects of the earth itself, which is a huge magnet, and to the local variations in the magnetism of the rocks underlying any given area. If only the earth as a large, uniform body were responsible for the magnetic lines, they would be essentially straight and simple. It is the local geology, however, which imparts complexities to the patterns of the magnetic lines. Such complexities or variations from a simple pattern are called anomalies.

Local magnetic effects vary from place to place because the magnetic properties of the respective rocks are not alike or because differences in rock structure from place to place change the magnetism measured at the surface. Rocks which have different kinds or different relative amounts of minerals, particularly iron-bearing minerals, have unlike magnetic properties. In general, the more iron minerals present, the stronger the magnetic effect. The iron oxide mineral, magnetite, has a strong magnetic effect even when present in small quantities; when present in large amounts, magnetite is of economic interest as a possible iron ore.

If in a given area the rocks have been folded or faulted by internal earth forces, the resulting variation in position of the different rocks will be indicated by variation in magnetic readings from place to place. Thus, structural complexities as well as mineral variations may be revealed by the magnetic data. Of particular interest are those magnetic variations or anomalies which are circular or tend to enclose a given area; the implication in such cases is that there is a specific, localized causative factor more or less pin-pointed by such a pattern.

The aeromagnetic survey of southeastern Pennsylvania was carried out with the use of an airborne magnetometer, an instrument towed by a plane. The plane covered the area by flying back and forth along straight, parallel flight lines spaced a quarter mile apart. An attempt was made to maintain an elevation of 500 feet, above the ground so as to eliminate magnetic changes due solely to terrain changes. An airborne magnetic survey has the advantage of eliminating very minor magnetic features on the ground, thus permitting a better evaluation of larger and deeper magnetic phenomena. It should be borne in mind that the instruments which have measured the magnetic effects in these studies are very sensitive and capable of detecting small changes. Proper evaluation of these changes is necessary to distinguish those situations which offer possibilities for economic mineral development from those cases where the information yielded is of more academic interest.

Media Quadrangle
U. S. Geological Survey Aeromagnetic Map G. P. 204

The northwestern third of the magnetic contour map of the Media quadrangle exhibits widely-spaced magnetic contours with no persistent or outstanding trend. This area is one which includes extensive areas of gabbroic gneiss and several belts of granitic gneiss. Neither of these rocks appear here to carry any significant magnetic concentration. The eastern half of the quadrangle, however, exhibits several elongate and circular magnetic anomalies and fairly close spacing of magnetic contour lines. This eastern portion of the quadrangle is composed of Wissahickon schist and gneiss as well as large masses of serpentine rock. These rocks are responsible for numerous anomalies and complex magnetic contour patterns in several parts of southeastern Pennsylvania.

An elongate positive magnetic anomaly extends for about 2 miles from Edgemont Township into Newton Township, near Florida Park. It is less than one-half mile wide and has an amplitude of less than 200 gammas. This anomaly corresponds with an area of serpentine rock which carries several iron-bearing minerals as well as a couple of percent of magnetite. The rock, however, shows no iron concentration of economic potentialities. This is further indicated by the low amplitude of the anomaly.

An oval, northeast-trending positive magnetic anomaly occurs about 3 miles west of Media, extending from Middletown Township into Edgemont Township. This anomaly is about 2 miles long and 1 mile wide and has an amplitude of about 400 gammas. The geologic map shows this to be part of a large area of gabbroic gneiss. Exposures of bedrock are few in this area, but hornblende schist and gabbroic gneiss may be observed. These contain numerous iron-bearing minerals as well as some magnetite which may be responsible for the anomaly. It is also possible that at a rather shallow depth there may be a mass of serpentine rock with some magnetite. The spacing of the contour lines suggests that the rock material responsible for the magnetic anomaly is a mass which is sloping downward to the southeast. This is a distinctive anomaly, yet its amplitude can be considered only moderate at most. In this general environment of crystalline and metamorphic rocks the outlook is not favorable for this anomaly area to carry any economic iron concentrations.

In the northeastern quarter of the quadrangle, four magnetic anomalies may be observed extending in a northeasterly direction from Sycamore Mills in Upper Providence Township. Each of these anomalies is oval-shaped, less than 1 mile in diameter, and shows a maximum amplitude of about 300 gammas. Three of these anomalies occur over a large mass of gabbroic gneiss which is quite variable in composition. The fourth anomaly of this group, the most northeasterly one, occurs over a mass of serpentine rock which in many areas is known to contain small amounts of the mineral magnetite. The three anomalies over gabbroic gneiss may be due to magnetite and other iron-bearing minerals somewhat concentrated in the gneiss or it is possible that these are bodies of serpentine rocks at a shallow depth beneath the surface of the gneiss. In general, neither the rock composition nor amplitude of the anomalies offers any real encouragement for iron concentrations of economic scope.

A small, circular positive magnetic anomaly occurs in Upper Providence Township, at Rose Tree, about 1 mile north of Media. The anomaly is less than 1 mile in diameter and has an amplitude of about 200 gammas. It occurs over a large, widespread area of Wissahickon schist and gneiss. This same variety of the Wissahickon Formation is responsible for similar anomalies in several other locations in southeastern Pennsylvania. Apparently there are small concentrations of magnetite and other iron-bearing minerals which are responsible for the anomaly, but such iron concentrations have not proved economically significant in the Wissahickon Formation and the small amplitude of this anomaly offers no further encouragement for development.

Bibliography

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